The GLOBE Science Log

GLOBE students will learn more about the process of science and will have a more authentic science experience if they keep a GLOBE Science Log, a scientific journal in which they record observations, write questions, develop theories and hypotheses, chart data, and preserve any other material relevant to their GLOBE investigations.

Keeping a science notebook or journal is an integral part of the scientific experience. All scientists keep written records of their work and most use a paper and pencil notebook. Field scientists as well as laboratory scientists find it essential to keep a record of observations, emerging theories, possible connections among phenomena, and ideas for further research. Even in this day of computer-based record-keeping, scientists still rely on hand-written observations.

Dr. M. Patricia Morse, a research biologist, has written:

"I wish someone had suggested to me earlier in my life, perhaps in high school, that I keep a journal with detailed records of dates and places, measurements, and drawings of the many organisms I see. I now recognize that my research journals, which I started in graduate school, are one of my most important tools. I have never recorded too much in my journals."

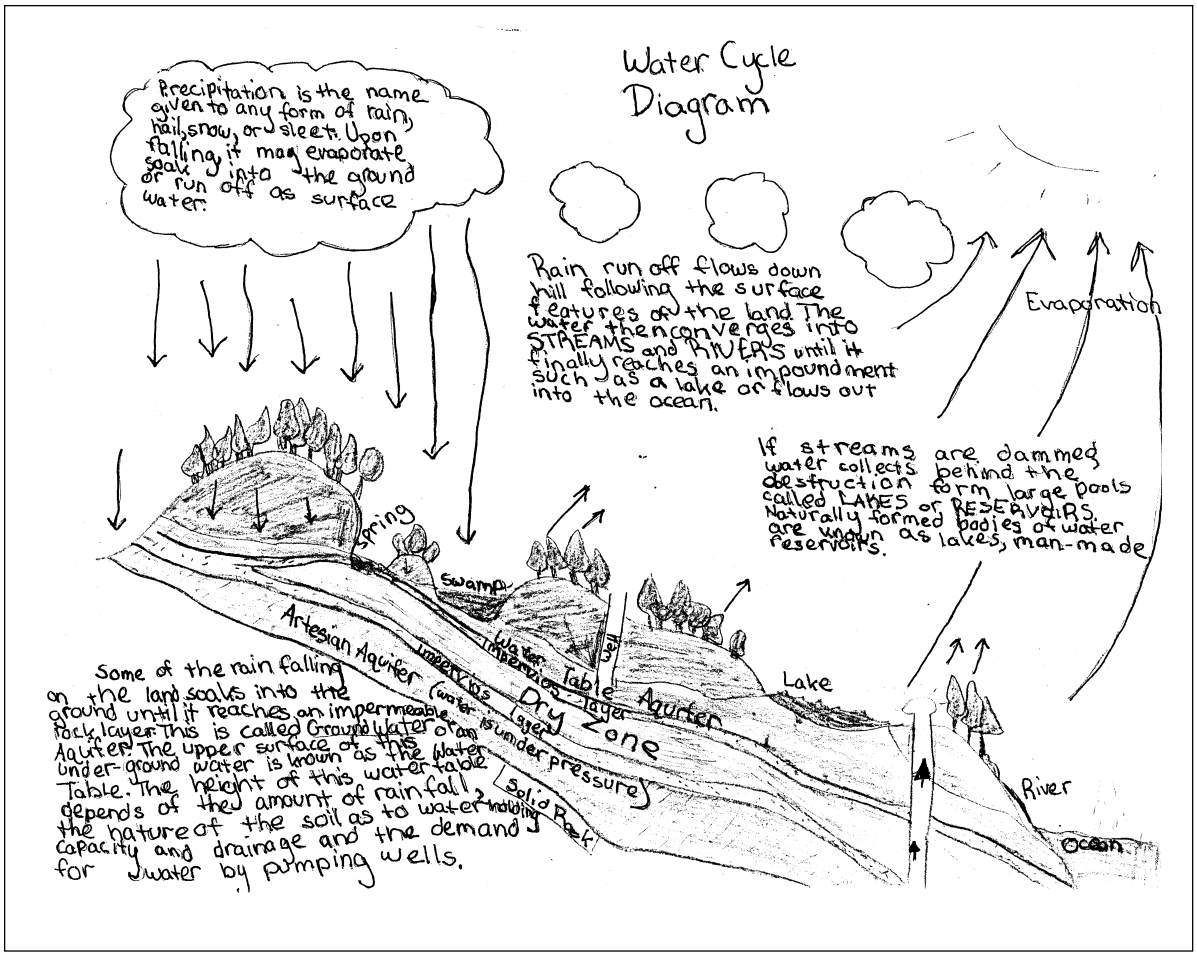
Global Lab Curriculum, Unit I, p. 24.

But not only scientists keep notebooks. Explorers, artists, and many other individuals to whom accurate information is important keep personal journals. Journals, logs, and notebooks are intimately connected with the scientific enterprise of exploration and discovery. Virtually every museum of science and discovery has on display journals and logbooks of famous explorers and scientists. Historically, personal field notes have been critically important both to those who recorded the information and to others who subsequently read the material. Students may be inspired to make entries in their journals if they learn about the journals of such explorers as Lewis and Clarke, Cook, Amundsen, and others.

What do journals look like?

In *The Journal Book*, Toby Fulwiler writes, that though journals vary widely, good ones share some common characteristics. Some of these are:

- Colloquial diction. Journals are not the place for polished sentences.
- First person voice. Journals are personal.
- Informal punctuation. Journals are not the place to work on grammar.
- Rhythms of everyday speech. "Journals are dialogical in nature, often documenting a running debate between a writer and one of his or her several selves; in such a conversation there is simply no point in writing in formal or pretentious prose." p. 2.
- Observations captured in numbers, words, and images.
- Questions. These are as important as the "facts."
- Speculation about connections and patterns, meanings, explanation. The journal is a place to try out ideas that are just emerging.
- Self-awareness. Journals often reveal how the writer views her/himself.
- Digressions that follow a wandering line of thought, not anticipated, but that perhaps will be returned to later and developed further.
- Synthesis of ideas and observations that were recorded separately.
- Interpretation of the things observed.
- Revisions. New information replaces old.



Here are some tips on how to make the GLOBE Science Log a valuable learning tool for your students.

Make Observations Central to the GLOBE Science Log

The science log is, above all else, a record of observations. Students will observe more carefully if they also record their observations in a permanent form, their science logs.

Ernst Mayr, the renowned evolutionary biologist, was once asked by a high school biology teacher what he could do to teach his students the most important things they needed to know. Professor Mayr replied, "The most important thing we can teach our young people is to observe well." (Leslie 1998, p. 157)

Personalize the Science Log

The GLOBE Science Log should be a *personal* journal of observation and reflection. Each student should keep an individual notebook. Encourage creativity in format and content. Emphasize that what one person considers important to record may seem unimportant to others, but that this is OK.

"Nature journaling is your path into the exploration of the natural world around you and into your personal connection with it." (Leslie 1998, p. 3.)

Record the Context of Your Observations

The observations will make more scientific sense if they include the context in which they are made. This is good scientific practice. Contextual data such as this is sometimes called *metadata*. Each

entry in the GLOBE Science Log should record the following contextual information:

- Date
- Location
- Time
- Environmental variables, such as weather

Distinguish Between Fact and Feeling

The science notebooks of Leonardo, Darwin, and Thoreau, to take three examples, include both fact and feeling. This is generally true of all personal science notebooks. Scientists record both what they observe and how they feel about it. But they try not to confuse the two. Help students be aware of the difference between recording objective facts and subjective feelings, at the same time that you encourage the recording of both. As an exercise in clarification, try asking them to highlight the "facts" in one color of marker and the "feelings" in another. Then discuss examples and how it is not always easy to tell which is which.

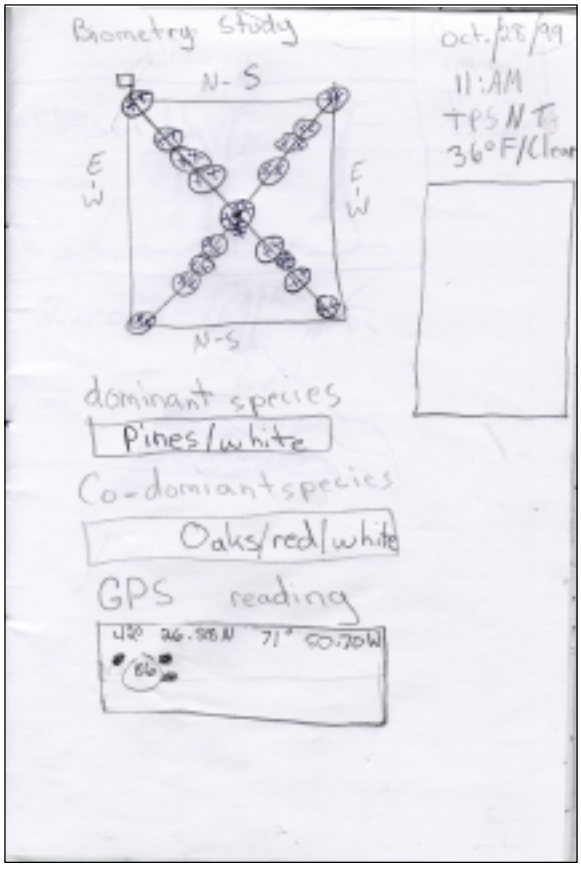
Record on a Regular Basis

Set aside regular times for students to work in their GLOBE Science Logs during the week. These may be the times when you collect GLOBE data, or may be in-class times for reflection. You may choose to have students write in their notebooks every day for a few weeks to establish the habit of recording observations and thoughts, then decrease the frequency as the value of their use has become clear.

In her book, *On the Having of Wonderful Ideas*, Eleanor Duckworth describes how regular observing and recording of the appearance of the moon in the sky from night to night opened up a huge set of questions for herself and her adult students. Through making careful, nightly observations and trying to explain them, they realized they didn't fully understand why the moon changed its appearance.

Encourage Students to Use Sketches

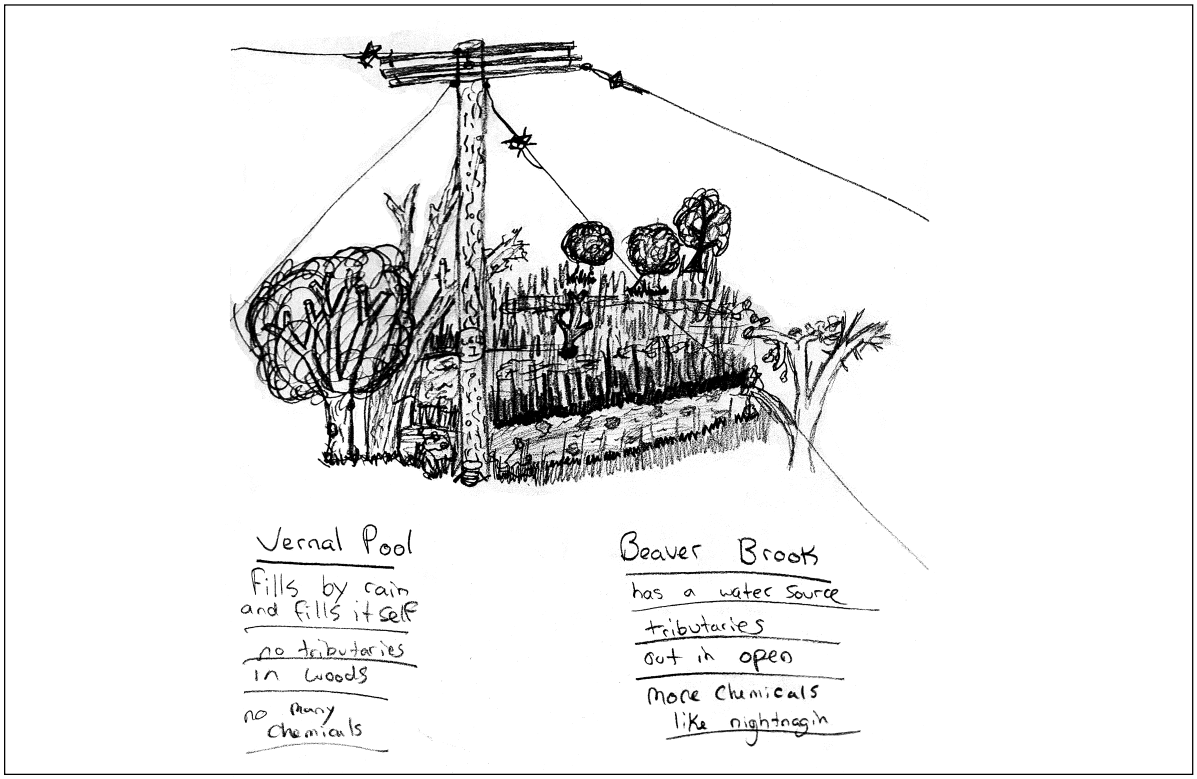
Some of your students will instantly love to make sketches of what they observe, but others will be reluctant, protesting that they "are no good at drawing." A number of educators suggest that you gently insist that everyone make sketches of what



they see, reassuring the reluctant artists that their sketches need not be perfect and that they will improve with practice. In the area of scientific sketching it may be important to stress that effort and practice, not innate talent, are what is important. Leslie, 1998, has a number of useful ideas and exercises to build confidence and skill.

Among the kinds of things that students may usefully sketch are:

- The GLOBE instrument shelter/ atmosphere station
- Any of the GLOBE study sites: hydrology, biology, soil.
- The school building itself and the vegetation around it
- A tree of the dominant species in the biology study site, including close-up sketches of bark, twigs, and leaves.
- The ground cover vegetation in the biology study site
- Clouds
- Any of the GLOBE measurement instruments



Model Good Journaling Yourself

Do not deprive yourself, as teacher, of the opportunity to grow through journaling! Keeping your own GLOBE Science Log will help you grow as a scientist and understand what the students are experiencing. From time to time share parts of your journal with your class. Take your own journal with you when you visit your GLOBE study sites and when your students write in their journals, write in your own. Do not use the time to grade papers!

Help Students Organize Their Notebooks

Bill McWeeny, an experienced science teacher, suggests a convenient way to index the entries in a student notebook – a method he calls "tabbing." Whenever he wants students to label a notebook entry, such as a writing assignment, a homework entry, or a particular lab, he gives the entry a number or a letter to identify it. Students use a small piece of masking tape or an adhesive label to make an index tab that sticks out a small distance from the relevant page and write the identifying number or letter on it. Thus, no matter where in the notebook this entry occurs, it can easily be found by its index tab. If you wish, you can specify that tabs across the top of pages are all of a type, those along the edge of another type, and those at the bottom another. Color coding is also possible, but you get the idea! Used with permission from *Global Lab, Unit 1*.

Periodically Review the Student Logs

The students' notebooks will be of more value if students review their entries frequently. One method is to have students write a weekly summary of things they have observed, questions that are still pending, and connections they have noticed. Another method for review is to have students exchange notebooks, read a specific section, and write comments to each other about the entries that were read. If the notebooks contain personal reflections, students may at first be reluctant to share them with their classmates. However, you can give them the opportunity to choose the material they will share, allowing them to keep private any material they wish to. You, as teacher, can model sharing by reading to the class from your own journal.

Use the Notebooks to Study Change

Some changes in the environment occur so slowly or over such long periods of time that they are difficult to detect except through long-term data collection. Your GLOBE Science Log can help you detect change over time if you are careful to record the date of your observations and if you subsequently review your entries with an eye to seeing how things have changed over time. In the movie, *Smoke*, one of the characters has been taking a photograph of the same Brooklyn street corner every day for many years. When another character learns of this, he expresses surprise—isn't it a boring set of pictures? But, when the photographer shows him the photos, no two are alike. Each captures a different slice of time and shows the evolution of the locale.

References

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